Indian Institute of Technology Patna
CS1101- Foundations of Programming

# Lab3: Data types and Expressions

Date: 19-8-2025

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**Task1: Using the provided base_convert program, complete the table with your own sample numbers. One example entry has already been filled in for you. (take minimum of 15 sample values)**

| Number | int | Binary (int) | Float (binary format) | Parsed Value (float) | Parsed Value (double) |
|---|---|---|---|---|---|
| -25.1 | -25 | (11111111111111111111111111100111)$_2$ (FFFFFFE7)$_{16}$ | (0b11000001110010000110011001101101)$_2$ (0xC1C8CCCD)$_{16}$ | -25.1000004 | -25.100000000000001 |
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**Task2: Develop a C program to determine, for each standard data type, its size (in bytes), minimum and maximum values, and the appropriate printf format specifiers; use these results to complete the table**

| Type | size | Max Value | Min Value | Format Spec. |
|---|---|---|---|---|
| char | 1 byte | 127 | -128 | %c/%d |
| | | | | |
| | | | | |

| …… | …… | …… | …… | …… |
|---|---|---|---|---|
| | | | | |

**//Sample Code**

```c
#include <stdio.h>
#include <limits.h>   // CHAR_MAX, SHRT_MAX, INT_MAX, LONG_MAX, LLONG_MAX, etc.
#include <float.h>    // FLT_MAX, DBL_MAX, LDBL_MAX, FLT_DIG, DBL_DIG, LDBL_DIG
#include <stdint.h>   // optional: fixed-width types (not used in the table)
int main(void) {
    /* Integer-family */
    printf("%-12s %-7zu %-28d %-18s\n", "char",        sizeof(char),        CHAR_MAX,      "%c / %d");
    printf("%-12s %-7zu %-28d %-18s\n", "short",       sizeof(short),       SHRT_MAX,      "%hd / %hu");
    printf("%-12s %-7zu %-28d %-18s\n", "int",         sizeof(int),         INT_MAX,       "%d / %u");
    printf("%-12s %-7zu %-28ld %-18s\n", "long",        sizeof(long),        LONG_MAX,      "%ld / %lu");
    printf("%-12s %-7zu %-28lld %-18s\n", "long long",   sizeof(long long),   LLONG_MAX,     "%lld / %llu");
    /* Floating-point family: For floats, the 'minimum' (DBL_MIN etc.) is the smallest positive normal number,
       not the most negative. Since we were asked for maxima, we print *MAX only*.  */
    printf("%-12s %-7zu %-28e %-18s\n", "float",       sizeof(float),       FLT_MAX,       "%f / %e / %g");
    printf("%-12s %-7zu %-28e %-18s\n", "double",      sizeof(double),      DBL_MAX,       "%lf / %e / %g");
    printf("%-12s %-7zu %-28Le %-18s\n", "long double", sizeof(long double), LDBL_MAX,      "%Lf / %Le / %Lg");
```

**Task3: Given the following data declaration statements:**

**int A, B=2, C=3;**

**char D='A';**

**float E=257.8;**

**long Fran=0xFFFFE;**

**unsigned Gill=0177777;**

**what is the value in each variable after each of the following statements(Write a C program to evaluate )**

(1) A = (B + C) * 2;

(2) A = B / (C + 1);

(3) A = (B % 3) + (C % 2);

(4) A = (B + 5) >> 1;

(5) A = (C - 2) << 3;

(6) A = (B & C) | 4;

(7) A = (B ^ C) & 7;

(8) A = ~(B | C);

(9) A = (B << 4) - (C >> 1);

(10) D = (B > C) ? B : C;

(11) A = (B < C) ? (C - B) : (B - C);

(12) E = (float)(B) / (C + 1);

(13) E = (double)(C) / (B + 2);

(14) A = (int)(E + 0.5);

(15) Fran = (Gill >> 3) & 0xFF;

(16) Gill = (Fran << 2) | 7;

(17) A = (B++ * --C);

(18) B = (C += 5) - 3;

(19) C = (A ^= (B | C));

(20) A = (Gill & 1) ? B : C;

(21) B = (A && C) || (B > 0);

(22) A = (B || C) && (A == 0);

(23) E = (float)(B * C) / (A + 1);

(24) Fran = (int)(E) ^ (Gill & 0xFFFF);

(25) A = (B += 2) * (C -= 1);

**Task 4: Develop a program that adds and multiplies two complex numbers. Also Compute their magnitude. Let the complex numbers be x=a+ib and y=c+jd.**

**In Record**

**Task 1, Task 2, and Task 4 are to be recorded**